

SEQUENCE LISTING

<110> Smeekens, J.C.M.
Ebskamp, Michael
Geerts, Hendrikis
Weisbeek, Petrus

<120> PRODUCTION OF OLIGOSACCHARIDES IN TRANSGENIC PLANTS

<130> ARNO-1-15313

<140> US 09/543,861

<141> 2000-03-24

<150> US 09/019,385

<151> 1998-02-05

<150> US 09/193,385

<151> 1998-11-17

<150> US 08/479,470

<151> 1995-06-07

<150> NL 1000064

<151> 1995-04-05

<150> NL 9401140

<151> 1994-08-07

<160> 12

<170> PatentIn version 3.2

<210> 1

<211> 2094

<212> DNA

<213> Barley

<220>

<221> CDS

<222> (46)..(1923)

<400> 1

gctcagaatc taccaaacc tctcggagtt gacgagcggc gccgc atg ggg tca cac 57
Met Gly Ser His
1

ggc aag cca ccg cta ccg tac gcc tac aag ccg ctg ccc tcg gac gcc 105
Gly Lys Pro Pro Leu Pro Tyr Ala Tyr Lys Pro Leu Pro Ser Asp Ala
5 10 15 20

gcc gac ggt aag cgg acc ggc tgc atg agg tgg tcc gcg tgt gcc acc Ala Asp Gly Lys Arg Thr Gly Cys Met Arg Trp Ser Ala Cys Ala Thr 25 30 35	153
gtg ctg acg gcc tcg gcc atg gcg gtg gtg gtg gtc ggc gcc acg ctc Val Leu Thr Ala Ser Ala Met Ala Val Val Val Val Gly Ala Thr Leu 40 45 50	201
ctg gcg gga ttg agg atg gag cag gcc gtc gac gag gag gcg gcg gcg Leu Ala Gly Leu Arg Met Glu Gln Ala Val Asp Glu Glu Ala Ala Ala 55 60 65	249
ggc ggg ttc ccg tgg agc aac gag atg ctg cag tgg cag cgc agc ggt Gly Gly Phe Pro Trp Ser Asn Glu Met Leu Gln Trp Gln Arg Ser Gly 70 75 80	297
tac cat ttc cag acg gcc aag aac tac atg agc gat ccc aac ggc ctg Tyr His Phe Gln Thr Ala Lys Asn Tyr Met Ser Asp Pro Asn Gly Leu 85 90 95 100	345
atg tat tac cgt gga tgg tac cac atg ttc tac cag tac aac ccg gtg Met Tyr Tyr Arg Gly Trp Tyr His Met Phe Tyr Gln Tyr Asn Pro Val 105 110 115	393
ggc acc gac tgg gac gac ggc atg gag tgg ggc cac gcc gtg tcc cgg Gly Thr Asp Trp Asp Asp Gly Met Glu Trp Gly His Ala Val Ser Arg 120 125 130	441
aac ctt gtc caa tgg cgc acc ctc cct atc gcc atg gtg gcc gac cag Asn Leu Val Gln Trp Arg Thr Leu Pro Ile Ala Met Val Ala Asp Gln 135 140 145	489
tgg tac gac atc ctc gga gtc ctc tcg ggc tcc atg acg gtg cta ccc Trp Tyr Asp Ile Leu Gly Val Leu Ser Gly Ser Met Thr Val Leu Pro 150 155 160	537
aac ggg acg gtc atc atg atc tac acg ggc gcc acc aac gcc tcc gcc Asn Gly Thr Val Ile Met Ile Tyr Thr Gly Ala Thr Asn Ala Ser Ala 165 170 175 180	585
gtg gag gtc cag tgc atc gcc acc ccg gcc gac ccc aac gac ccc ctc Val Glu Val Gln Cys Ile Ala Thr Pro Ala Asp Pro Asn Asp Pro Leu 185 190 195	633
ctc cgc cgg tgg acc aag cac ccc gcc aac ccc gtc atc tgg tcg ccg Leu Arg Arg Trp Thr Lys His Pro Ala Asn Pro Val Ile Trp Ser Pro 200 205 210	681
ccg ggg gtc ggc acc aag gat ttc cga gac ccg atg acc gcc tgg tac Pro Gly Val Gly Thr Lys Asp Phe Arg Asp Pro Met Thr Ala Trp Tyr 215 220 225	729

gac gag tcc gac gag aca tgg cgc acc ctc ctc ggg tcc aag gac gac Asp Glu Ser Asp Glu Thr Trp Arg Thr Leu Leu Gly Ser Lys Asp Asp	777
230 235 240	
cac gac ggc cac cac gac ggc atc gcc atg atg tac aag acc aag gac His Asp Gly His His Asp Gly Ile Ala Met Met Tyr Lys Thr Lys Asp	825
245 250 255 260	
ttc ctc aac tac gag ctc atc ccg ggc atc ttg cac cgg gtg gtg cgc Phe Leu Asn Tyr Glu Leu Ile Pro Gly Ile Leu His Arg Val Val Arg	873
265 270 275	
acc ggc gag tgg gag tgc atc gac ttc tac ccc gtc ggc cgg aga agc Thr Gly Glu Trp Glu Cys Ile Asp Phe Tyr Pro Val Gly Arg Arg Ser	921
280 285 290	
agc gac aac tcg tcg gag atg ctg cac gtg ttg aag gcg agc atg gac Ser Asp Asn Ser Ser Glu Met Leu His Val Leu Lys Ala Ser Met Asp	969
295 300 305	
gac gaa cgg cac gac tac tac tcg ctg ggc acg tac gac tcg gcg gcc Asp Glu Arg His Asp Tyr Tyr Ser Leu Gly Thr Tyr Asp Ser Ala Ala	1017
310 315 320	
aac acg tgg acg ccc atc gac ccg gag ctc gac ttg ggg atc ggg ctg Asn Thr Trp Thr Pro Ile Asp Pro Glu Leu Asp Leu Gly Ile Gly Leu	1065
325 330 335 340	
aga tac gac tgg gga aag ttt tat gcg tcc acc tcc ttc tat gat ccg Arg Tyr Asp Trp Gly Lys Phe Tyr Ala Ser Thr Ser Phe Tyr Asp Pro	1113
345 350 355	
gcc aag aac cgg cgc gtg ctc atg ggg tac gtc ggc gag gtc gac tcc Ala Lys Asn Arg Arg Val Leu Met Gly Tyr Val Gly Glu Val Asp Ser	1161
360 365 370	
aag cgg gct gat gtc gtc aag gga tgg gct tcc att cag tca gtt cct Lys Arg Ala Asp Val Val Lys Gly Trp Ala Ser Ile Gln Ser Val Pro	1209
375 380 385	
agg acg gtg gct ctg gat gag aag acc cgg acg aac ctc ctg ctc tgg Arg Thr Val Ala Leu Asp Glu Lys Thr Arg Thr Asn Leu Leu Leu Trp	1257
390 395 400	
ccc gtt gag gag atc gag acc ctc cgc ctc aat gcc acg gaa ctg acc Pro Val Glu Glu Ile Glu Thr Leu Arg Leu Asn Ala Thr Glu Leu Thr	1305
405 410 415 420	
gac gtt acc att aac act ggc tcc gtc atc cat atc ccg ctc cgc caa Asp Val Thr Ile Asn Thr Gly Ser Val Ile His Ile Pro Leu Arg Gln	1353
425 430 435	

ggc act cac gct cga cat gcg gag gcc tct ttc cac ctt gat gct tcc	1401
Gly Thr His Ala Arg His Ala Glu Ala Ser Phe His Leu Asp Ala Ser	
440 445 450	
gcc gtg gct gcc ctc aac gag gcc gat gtg ggc tac aac tgc agt agc	1449
Ala Val Ala Ala Leu Asn Glu Ala Asp Val Gly Tyr Asn Cys Ser Ser	
455 460 465	
agc ggc ggc gct gtt aac cgc ggc gcg cta ggc ccc ttc ggc ctc ctc	1497
Ser Gly Gly Ala Val Asn Arg Gly Ala Leu Gly Pro Phe Gly Leu Leu	
470 475 480	
gtc ctc gcc gcc ggt gac cgc cgt ggc gag caa acg gcg gtc tac ttc	1545
Val Leu Ala Ala Gly Asp Arg Arg Gly Glu Gln Thr Ala Val Tyr Phe	
485 490 495 500	
tac gtg tct agg ggc ctt gac gga ggc ctc cac acc agc ttc tgc caa	1593
Tyr Val Ser Arg Gly Leu Asp Gly Gly Leu His Thr Ser Phe Cys Gln	
505 510 515	
gat gag ctg aga tcg tca cga gcc aag gat gtg acc aag cgt gtc atc	1641
Asp Glu Leu Arg Ser Ser Arg Ala Lys Asp Val Thr Lys Arg Val Ile	
520 525 530	
ggg agc acg gtg ccg gtg ctc gac ggt gag gct ttg tca atg agg gtg	1689
Gly Ser Thr Val Pro Val Leu Asp Gly Glu Ala Leu Ser Met Arg Val	
535 540 545	
ctc gtg gat cac tcc atc gtg cag ggc ttc gac atg ggc ggg agg acc	1737
Leu Val Asp His Ser Ile Val Gln Gly Phe Asp Met Gly Gly Arg Thr	
550 555 560	
acg atg acc tcg ccg gtg tac ccg atg gag tcg tat cag gag gca aga	1785
Thr Met Thr Ser Arg Val Tyr Pro Met Glu Ser Tyr Gln Glu Ala Arg	
565 570 575 580	
gtc tac ttg ttc aac aac gcc acc ggt gcc agc gtg acg gcg gaa agg	1833
Val Tyr Leu Phe Asn Asn Ala Thr Gly Ala Ser Val Thr Ala Glu Arg	
585 590 595	
ctg gtc gtg cac gag atg gac tcg gca cac aac cag ctc tcc aat gag	1881
Leu Val Val His Glu Met Asp Ser Ala His Asn Gln Leu Ser Asn Glu	
600 605 610	
gac gat ggc atg tat ctt cat caa gtt ctt gaa tct cgt cat	1923
Asp Asp Gly Met Tyr Leu His Gln Val Leu Glu Ser Arg His	
615 620 625	
taataagcta cattggatca aagaagatca ccagggaagg gcaattcata cataaatcga	1983
atcattctgc acaacctcgc ttgcagcatg cattgaaaca tctgtatttg gatcatcttc	2043

ttcatttatg tcatagtgaa ctatattact ttgtaaaaaa aaaaaaaaaa a

2094

<210> 2
 <211> 626
 <212> PRT
 <213> Barley

<400> 2

Met Gly Ser His Gly Lys Pro Pro Leu Pro Tyr Ala Tyr Lys Pro Leu
 1 5 10 15

Pro Ser Asp Ala Ala Asp Gly Lys Arg Thr Gly Cys Met Arg Trp Ser
 20 25 30

Ala Cys Ala Thr Val Leu Thr Ala Ser Ala Met Ala Val Val Val Val
 35 40 45

Gly Ala Thr Leu Leu Ala Gly Leu Arg Met Glu Gln Ala Val Asp Glu
 50 55 60

Glu Ala Ala Ala Gly Gly Phe Pro Trp Ser Asn Glu Met Leu Gln Trp
 65 70 75 80

Gln Arg Ser Gly Tyr His Phe Gln Thr Ala Lys Asn Tyr Met Ser Asp
 85 90 95

Pro Asn Gly Leu Met Tyr Tyr Arg Gly Trp Tyr His Met Phe Tyr Gln
 100 105 110

Tyr Asn Pro Val Gly Thr Asp Trp Asp Asp Gly Met Glu Trp Gly His
 115 120 125

Ala Val Ser Arg Asn Leu Val Gln Trp Arg Thr Leu Pro Ile Ala Met
 130 135 140

Val Ala Asp Gln Trp Tyr Asp Ile Leu Gly Val Leu Ser Gly Ser Met
 145 150 155 160

Thr Val Leu Pro Asn Gly Thr Val Ile Met Ile Tyr Thr Gly Ala Thr
 165 170 175

Asn Ala Ser Ala Val Glu Val Gln Cys Ile Ala Thr Pro Ala Asp Pro
 180 185 190

Asn Asp Pro Leu Leu Arg Arg Trp Thr Lys His Pro Ala Asn Pro Val
 195 200 205

Ile Trp Ser Pro Pro Gly Val Gly Thr Lys Asp Phe Arg Asp Pro Met
 210 215 220

Thr Ala Trp Tyr Asp Glu Ser Asp Glu Thr Trp Arg Thr Leu Leu Gly
 225 230 235 240

Ser Lys Asp Asp His Asp Gly His His Asp Gly Ile Ala Met Met Tyr
 245 250 255

Lys Thr Lys Asp Phe Leu Asn Tyr Glu Leu Ile Pro Gly Ile Leu His
 260 265 270

Arg Val Val Arg Thr Gly Glu Trp Glu Cys Ile Asp Phe Tyr Pro Val
 275 280 285

Gly Arg Arg Ser Ser Asp Asn Ser Ser Glu Met Leu His Val Leu Lys
 290 295 300

Ala Ser Met Asp Asp Glu Arg His Asp Tyr Tyr Ser Leu Gly Thr Tyr
 305 310 315 320

Asp Ser Ala Ala Asn Thr Trp Thr Pro Ile Asp Pro Glu Leu Asp Leu
 325 330 335

Gly Ile Gly Leu Arg Tyr Asp Trp Gly Lys Phe Tyr Ala Ser Thr Ser
 340 345 350

Phe Tyr Asp Pro Ala Lys Asn Arg Arg Val Leu Met Gly Tyr Val Gly
 355 360 365

Glu Val Asp Ser Lys Arg Ala Asp Val Val Lys Gly Trp Ala Ser Ile
 370 375 380

Gln Ser Val Pro Arg Thr Val Ala Leu Asp Glu Lys Thr Arg Thr Asn
 385 390 395 400

Leu Leu Leu Trp Pro Val Glu Glu Ile Glu Thr Leu Arg Leu Asn Ala
 405 410 415

Thr Glu Leu Thr Asp Val Thr Ile Asn Thr Gly Ser Val Ile His Ile
 420 425 430

Pro Leu Arg Gln Gly Thr His Ala Arg His Ala Glu Ala Ser Phe His
 435 440 445

Leu Asp Ala Ser Ala Val Ala Ala Leu Asn Glu Ala Asp Val Gly Tyr
 450 455 460

Asn Cys Ser Ser Ser Gly Gly Ala Val Asn Arg Gly Ala Leu Gly Pro
 465 470 475 480

Phe Gly Leu Leu Val Leu Ala Ala Gly Asp Arg Arg Gly Glu Gln Thr
 485 490 495

Ala Val Tyr Phe Tyr Val Ser Arg Gly Leu Asp Gly Gly Leu His Thr
 500 505 510

Ser Phe Cys Gln Asp Glu Leu Arg Ser Ser Arg Ala Lys Asp Val Thr
 515 520 525

Lys Arg Val Ile Gly Ser Thr Val Pro Val Leu Asp Gly Glu Ala Leu
 530 535 540

Ser Met Arg Val Leu Val Asp His Ser Ile Val Gln Gly Phe Asp Met
 545 550 555 560

Gly Gly Arg Thr Thr Met Thr Ser Arg Val Tyr Pro Met Glu Ser Tyr
 565 570 575

Gln Glu Ala Arg Val Tyr Leu Phe Asn Asn Ala Thr Gly Ala Ser Val
 580 585 590

Thr Ala Glu Arg Leu Val Val His Glu Met Asp Ser Ala His Asn Gln
 595 600 605

Leu Ser Asn Glu Asp Asp Gly Met Tyr Leu His Gln Val Leu Glu Ser
 610 615 620

Arg His
 625

<210> 3
 <211> 30
 <212> DNA
 <213> Artificial Sequence

<220>
 <223> Synthetic DNA

<400> 3
 ggctctcttc tgttccatgg cagatgaagc

30

<210> 4
 <211> 36
 <212> DNA
 <213> Artificial Sequence

<220>
 <223> Synthetic DNA

<400> 4
 cgcctgcagg taccacatgt tytaycarta yaaycc

36

<210> 5
 <211> 35
 <212> DNA
 <213> Artificial Sequence

<220>
 <223> Synthetic DNA

<400> 5
 ccacgtctag agctctcrtc rtaccavgcs gtcac

35

<210> 6
 <211> 47

<212> PRT
 <213> Barley

<400> 6

His Phe Gln Thr Ala Lys Asn Tyr Met Ser Asp Pro Asn Gly Leu Met
 1 5 10 15

Tyr Tyr Arg Gly Trp Tyr His Met Phe Tyr Gln Tyr Asn Pro Val Gly
 20 25 30

Thr Asp Trp Asp Asp Gly Met Glu Trp Gly His Ala Val Ser Arg
 35 40 45

<210> 7
 <211> 11
 <212> PRT
 <213> Barley

<400> 7

Trp Glu Cys Ile Asp Phe Tyr Pro Val Gly Arg
 1 5 10

<210> 8
 <211> 8
 <212> PRT
 <213> Barley

<400> 8

Ser Gly Ser Met Thr Val Leu Pro
 1 5

<210> 9
 <211> 10
 <212> PRT
 <213> Barley

<400> 9

Phe Arg Asp Pro Met Thr Ala Trp Tyr Asp
 1 5 10

<210> 10
 <211> 11

<212> PRT
 <213> Barley

<400> 10

Asp Trp Gly Lys Phe Tyr Ala Ser Thr Ser Phe
 1 5 10

<210> 11
 <211> 13
 <212> PRT
 <213> Helianthus tuberosus

<220>
 <221> misc_feature
 <222> (6)..(6)
 <223> Xaa can be any naturally occurring amino acid

<220>
 <221> MISC_FEATURE
 <222> (12)..(13)
 <223> Xaa = unknown

<400> 11

Glu Gln Trp Glu Gly Xaa Phe Met Gln Gln Tyr Xaa Xaa
 1 5 10

<210> 12
 <211> 15
 <212> PRT
 <213> Helianthus tuberosus

<220>
 <221> MISC_FEATURE
 <222> (5)..(5)
 <223> Xaa = unknown

<220>
 <221> MISC_FEATURE
 <222> (7)..(8)
 <223> Xaa = unknown

<220>
 <221> MISC_FEATURE
 <222> (11)..(11)
 <223> Xaa = phenylalanine or leucine

<220>
 <221> MISC_FEATURE
 <222> (13)..(13)
 <223> Xaa = unknown

<400> 12

Ala	Val	Pro	Val	Xaa	Leu	Xaa	Xaa	Pro	Leu	Xaa	Ile	Xaa	Trp	Val
1				5					10					15